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The use of the ASTRO-PU and the ASTRO(97)-PU in the setting of prescribing budgets in English general practice

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SUMMARY

Objectives: To examine the variation in prescribing costs explained by the Age, Sex and Temporary Resident Originated Prescribing Unit (ASTRO-PU) and its replacement, the ASTRO (97)-PU, in order to determine the appropriateness of their use in the setting of prescribing budgets in English general practice.

Methods: Linear regression analysis was used to analyse routinely collected patient and prescribing data from one English health authority (Lincolnshire Health) for the fiscal year 1995.

Results: The goodness-of-fit of the regression models constructed varied according to whether practices had dispensing status (i.e. rural practices that have permission to dispense drugs to their own patients as a means of compensating for the lack of pharmacies in such areas), with the ASTRO-PU and ASTROP(97)-PU explaining a higher proportion of the variation in prescribing costs amongst practices with such status.

Conclusions: This paper draws two main conclusions. First, the weights embodied in the ASTRO-PU and the ASTRO(97)-PU may have been biased by the number of dispensing practices sampled during their construction. Second, the denominators may be more applicable to dispensing practices, implying that primary care groups may need to follow the principle of 'local flexibility' during the budget-setting process.

INTRODUCTION

The White paper *The new NHS: Modern, Dependable* outlined the Labour Government's plans to introduce 500 primary care groups (PCGs) throughout England, each serving a population of approximately 100 000 people (1). From April 1999 onwards, each PCG will have a cash-limited budget for the purchase of hospital and community health services, prescribing and general practice infrastructure. Over time, the Government intends that these new bodies will allocate indicative budgets to individual practices within their areas for the full range of services, but that no individual element will be artificially capped. However, 'initially every practice will have a prescribing budget, as most do now' (1, chapter 5, page 8).

In April 1991, prescribing budgets were introduced into English general practice under the auspices of the fundholding and indicative prescribing scheme (2). Initially, practice-level prescribing budgets were set on a historic cost basis. However, from the fiscal year 1993 onwards, health authorities in England were advised to use the Age, Sex and Temporary Resident Originated Prescribing Unit (ASTRO-PU) to help set prescribing budgets for fundholding and non-fundholding practices. The ASTRO-PU was calculated using data from a sample of 90 practices from the VAMP database for the fiscal year 1990 (3). The raw age-and-sex weights obtained from the database were rounded to the nearest integer in order to make ASTRO-PU calculations easier to perform. However, as Table 1 shows, the process of rounding significantly over- and under-weighted some age groups, particularly males aged 15–34 years.

Using a sample of 112 practices from the Intercontinental Medical Statistics (IMS) database, the validity of the ASTRO-PU was tested using data from the fiscal year 1993 (4). As Table 2 shows, the architects of the denominator commented that the weights estimated using the IMS data were 'reassuringly similar to those of the existing ASTRO-PU system' (4, page 991). However, in response to evidence from the Statistical Bulletin that some of the weights associated

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Table 1. Conversion of raw ASTRO-PU weights into integer values

Age bands (years)	Raw weights		ASTRO-PU sample		% difference	
	Male	Female	Male	Female	Male	Female
0–4	1·05	0·95	1	1	−4·76	5·26
5–14	1·06	1·04	1	1	−5·66	−3·85
15–24	1·34	1·89	1	2	−25·37	5·82
25–34	1·38	2·14	1	2	−27·54	−6·54
35–44	1·97	2·91	2	3	1·52	3·09
45–54	3·10	4·25	3	4	−3·23	−5·88
55–64	6·01	6·36	6	6	−0·17	−5·66
65–74	9·99	9·82	10	10	0·10	1·83
≥75	9·78	12·02	10	12	2·25	−0·17
Temps.	0·54		0·50		−7·41	

Temps. = temporary residents.

Table 2. ASTRO-PU weights calculated using the IMS and VAMP databases

Age bands (years)	IMS data		ASTRO-PU sample		% difference	
	Male	Female	Male	Female	Male	Female
0–4	1	1	1	1	0·00	0·00
5–14	1	1	1	1	0·00	0·00
15–24	1	2	1	2	0·00	0·00
25–34	1	2	1	2	0·00	0·00
35–44	2	3	2	3	0·00	0·00
45–54	3	5	3	4	0·00	−20·00
55–64	6	7	6	6	0·00	−14·29
65–74	9	9	10	10	11·11	11·11
≥75	11	11	10	12	−9·09	9·09
Temps.	0.20		0.50		150·00	

Temps. = temporary residents.

with the denominator's age-and-sex groups may have altered (5), the ASTRO-PU was recalculated using data from 123 IMS practices for the period November 1995–October 1996. Indeed, changes in prescribing patterns since the fiscal year 1990 and the rounding of its weights to integers suggests that the ASTRO-PU had (increasingly over time) given 'undue weighting to the elderly', which could have had 'important implications for the calculation of practice budgets, particularly if cost per ASTRO-PU was the dominant component' (6, page 84).

Given the growing inaccuracy of the denominator, the architects of the ASTRO-PU decided to recalculate its weights and to present the new values to one

Table 3. ASTRO-PU and ASTRO(97)-PU weights

Age bands (years)	ASTRO-PU		ASTRO(97)-PU		% difference	
	Male	Female	Male	Female	Male	Female
0–4	1	1	1	0·8	0·00	−20·00
5–14	1	1	1·4	1·2	40·00	20·00
15–24	1	2	1·7	2·1	70·00	5·00
25–34	1	2	2·0	2·4	100·00	20·00
35–44	2	3	2·8	3·2	40·00	6·67
45–54	3	4	4·4	5·4	46·67	35·00
55–64	6	6	7·6	7·2	26·67	20·00
65–74	10	10	10·1	9·6	1·00	−4·00
≥75	10	12	11·8	10·6	18·00	−11·67
Temps.	0·5		0·5		0·00%	

Temps. = temporary residents.

decimal place. The new measure was named the ASTRO(97)-PU, although it was based on data from 1995 and 1996. Table 3 shows that many of the age-and-sex weights embodied in the new measure were significantly larger than those included in the ASTRO-PU. Given the denominator's superior accuracy, the architects of the ASTRO(97)-PU suggested that its 'new weightings should be used for budget setting' (6, page 85). Accepting the need to develop robust budget allocation formulae for PCGs and for practices in the new NHS, this paper examines the use of the ASTRO-PU and the ASTRO (97)-PU in the setting of prescribing budgets in English general practice.

METHODS

In order to determine the proportion of practice-level variations in prescribing costs explained by the ASTRO-PU and the ASTRO (97)-PU, prescribing cost and patient characteristics data for the fiscal year 1995 were collected from the English health authority Lincolnshire Health. As differences in prescribing costs have been found to exist between dispensing and non-dispensing in English general practice, practices within the authority were split into two cohorts based on their dispensing status (7). Dispensing practices are rural practices that have been granted permission to dispense drugs to their own patients as a means of compensating for the low density of pharmacies in such areas (8). The sample analysed contained 63 dispensing and 44 non-dispensing practices.

Practice prescribing cost data were collected by personnel within Lincolnshire Health from the Prescribing Analysis and CosT database. In the database, prescribing expenditure is measured in terms of 'net ingredient cost', that is, NHS expenditure on drugs dispensed, excluding dispensing fees and any discounts offered. Practice, age, sex and temporary-resident data were also collected from the authority's information systems. Exploratory regression analyses were performed using the SPSS statistics package. All results reported as statistically significant are so at the 5% level or below.

RESULTS

Table 4 presents the results of the linear regression analysis undertaken for Lincolnshire's dispensing and non-dispensing practices. From the results, three main conclusions can be drawn. First, the insignificance of the constant terms implies that Lincolnshire practices with no patients would have had zero drug expenditure, as the regression lines passed through the origin. Second, the goodness-of-fit of the models varied according to dispensing status, which suggests that

Table 4. Regression analyses of ASTRO-PU and ASTRO(97)-PU per patient on 'net ingredient cost' per patient, in the fiscal year 1995

Groups	Constant	Significance of constant	Coefficient	Significance of coefficient	Adjusted R^2
ASTRO-PUs per patient					
Dispensing	1·44	0·9203	20·55	0·0000	0·3692
Non-dispensing	26·43	0·1163	12·19	0·0068	0·1419
ASTRO(97)-PUs per patient					
Dispensing	−9·54	0·5708	20·41	0·0000	0·3514
Non-dispensing	20·24	0·2684	12·10	0·0053	0·1512

the ASTRO-PU and ASTRO(97)-PUs had greater explanatory power when explaining the variation in costs amongst the county's dispensing practices. Finally, although its weights were designed to be more accurate, in this case, the ASTRO(97)-PU did not explain substantially more of the variation in prescribing costs than its predecessor.

DISCUSSION

The generalizability of the ASTRO-PU and the ASTRO(97)-PU depends upon the appropriateness of their weights to practices and years other than those sampled. Although exploratory, the results of the regression analysis presented in Table 4 suggest that the proportion of dispensing practices in the VAMP and IMS databases may have affected the weights embodied in the denominators. When compared to the national average for the fiscal year 1994, the IMS database had over three times as many dispensing practices. The results of the regression analysis therefore suggest that the prescribing cost denominators may have been more applicable to areas that had similar proportions of such practices to those in the VAMP and IMS databases. For example, use of the ASTRO(97)-PU may be less appropriate in inner-city areas with no dispensing practices.

As outlined in the introduction, the average weights associated with age, sex and temporary-resident-related variations in prescribing costs in English general practice may have changed over time. In consequence, to remain accurate the ASTRO(97)-PU's weights should be re-estimated and revised whenever demographic prescribing patterns significantly alter. However, as budget-setting authorities set prescribing budgets for the forthcoming financial year, perhaps the weights embodied in the denominator should be 'prospective' rather than 'retrospective'. In other words, the weights should be updated annually in a way that takes account of how prescribing patterns are likely to change over the following 12 months; rather than measuring the way in which practices sampled previously prescribed, during the particular year studied.

The architects of the ASTRO-PU and the ASTRO(97)-PU adopted a 'positive approach' to calculating their weights, that is, they attempted to measure observable age, sex and temporary-resident-related variations in prescribing costs in English general practice. Alternatively, if they had adopted a 'normative approach' they would have been required to specify the weights that *should be* given to each age, sex and temporary-resident group, regardless of current or previous practice. For example, a normative statement could specify that 15 times as much *should be* spent on females aged 75 years and over; although a weight of 10·6 was observed with the calculation of the ASTRO(97)-PU. However, under this approach, a means of determining the appropriate normative weights would be required.

Because the weights embodied in the ASTRO-PU and ASTRO(97)-PU were retrospective and possibly biased, a normative approach may, indeed, be a preferable alternative. For example, PCGs could negotiate with local practices in order to determine how much local practices should spend on each age, sex and temporary-resident

group over the next financial year. Indeed, some degree of 'local flexibility' is likely to be required if PCGs are to set budgets that give practices sufficient funds to meet their patients' needs for prescribed drugs.

An alternative to positive or normative prescribing weights may be patient-based measures of need. For example, patient characteristics (such as medical condition, severity of illness, etc.) could be collected and included in the PACT database. In consequence, budget-setting authorities could audit a practice's prescribing patterns and estimate whether its prescribing is rational. Patient-level assessment may be more accurate than age, sex and temporary-resident-based proxies for need. Indeed, the latter approach is only able to reflect the average patient's need for prescribed drugs in each of the demographic groups and may therefore be inaccurate for the majority of patients whose requirements are above or below the average. However, the inclusion of patient characteristics in the PACT database would require much extra effort and investment by practices, with no guarantees that the information recorded would be accurate.

Finally, the use of the ASTRO-PU or the ASTRO(97)-PU to set prescribing budgets without reference to a practice's expenditure on non-drug services may be inappropriate. Indeed, the setting of cash-limited budgets for all hospital and community services, prescribing and general practice infrastructure is intended to make PCGs more aware of the trade-offs between different types of NHS expenditure. Therefore, it may also be necessary to alter the various ASTRO-PU and ASTRO(97)-PU weights to take account of differences in levels of expenditure on non-prescribing services between different practices.

In summary, the likelihood that the ASTRO-PU and the ASTRO(97)-PU weights may change over time and may have been biased by the sampling of IMS practices suggests that the denominators should be used with caution during the budget-setting process. Indeed, if the ASTRO-PU or ASTRO(97)-PU are used to set practice-level prescribing budgets, PCGs should consider the relevance or desirability of the denominators' weights to a particular practice when determining the size of the allocation given. As a result, PCGs may wish to use the denominators as a benchmark from which to begin negotiations with practices about what would constitute a fair and sufficient budget; rather than using the denominators as mechanistic budget-setting devices. Indeed, a degree of 'local flexibility' is probably desirable during the budget-setting process, because the ASTRO-PU or the ASTRO(97)-PU alone are unlikely to produce an estimate of the funds that practices require to meet their patients' needs for prescribed drugs.

CONCLUSIONS

This paper discusses the construction of the ASTRO-PU and the ASTRO(97)-PU and their use during the budget-setting process and draws two main conclusions. First, that the construction of the denominators may have been biased by the sampling of VAMP and IMS practices. Second, that the denominators may more applicable to dispensing practices, implying that PCGs may wish to follow the principle of 'local flexibility' during the budget-setting process.

Given the analysis of the ASTRO-PU and the ASTRO(97)-PU outlined here, further investigation into the implications of their use during the budget-setting process may be necessary. However, even if such work is undertaken, it may be found that the retrospective and positive approaches taken during the denominators' construction makes them a limited basis upon which to set prescribing budgets in English general practice.

Finally, two possible limitations of the analysis presented in this paper should be stated. First, data were only collected from one health authority for 1 year. Therefore, further research covering more years and practices is required. Second, the small number of practices sampled suggests that the results of some of the regression models constructed may be unreliable. Therefore, further statistical analysis based upon a larger sample of practices may be required. Despite the possible limitations of the paper, the Labour Government's plans to give cash-limited budgets to PCGs for all aspects of patient care suggests that, before April 1999, more debate about how scarce NHS resources should be allocated may be required.

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